

## CLAIMES

1. Production design support facility designed to be capable of performing a production design of a prescribed product present in a real space and formed by assembling prescribed components, by displaying the components in a virtual space, comprising:

cooperation management means for associating assembly procedure data showing combination of the assembly enabled components and assembling order thereof with component object data for displaying the component in the virtual space as a component object and managing them;

object display means for displaying the component object in the virtual space based on the component object data;

coordinate data acquisition means for acquiring coordinate data of the component object displayed in the virtual space by the object display means; and

element working time output means for outputting an element working time required for an assembly of the components, on the basis of each coordinate data of one component object and the other component objects acquired by the coordinate data acquisition means, and assembly procedure data related to the objects and cooperatively managed by the cooperation means.

2. The production design support facility according

to claim 1, comprising assembly enabled relation determination means for determining whether or not one component and the other components related to the component object displayed in the virtual space have assembly enabled relation, based on the assembly procedure data managed by the cooperation management means,

wherein when the assembly enabled relation determination means determines that the components have assembly enabled relation, the element working time output means outputs the element working time required for the assembly of the components, based on each coordinate data of one component object and the other component objects acquired by the coordinate data acquisition means.

3. The production design support facility according to claim 2, comprising:

first report means for reporting the information showing that the components have not assembly enabled relation in a combination of the components in the assembly procedure data, when the assembly enabled relation determination means determines accordingly.

4. The production design support facility according to claim 3, wherein the first report means reports the information showing that the components have not the assembly

enabled relation, or the information suggesting the combination of assembly enabled components, instead of the information showing that the components have not the assembly enabled relation.

5. The production design support facility according to any one of claims 2 to 4, comprising:

second report means for reporting the information showing that the components have not the assembly enabled relation in the combination order in the assembly procedure data, when the assembly enabled relation determination means determines accordingly.

6. The production design support facility according to claim 5, wherein the second report means reports the information showing that the components have not the assembly enabled relation, or the information suggesting an assembly enabled assembly procedure, instead of the information showing that the components have not the assembly enabled relation.

7. The production design support facility according to any one of claims 1 to 6, comprising:

object moving instruction reception means for receiving an instruction to move the component object displayed in the virtual space to an arbitrary position in the virtual space,

as an object moving instruction,

wherein the object display means is adapted to display the component object according to the object moving instruction received by the object moving instruction reception means.

8. The production design support facility according to claim 7,

wherein the object display means displays a component supply unit for supplying a prescribed component in the virtual space as a component supply unit object, based on component supply unit object data;

the cooperation management means cooperates and manages assembly procedure data and the component supply unit object data, assembly procedure data further showing a combination of the prescribed component and the component supply unit object; and

the object moving instruction reception means is further adapted to receive an instruction to move the component supply unit object displayed by the object display means, to the arbitrary position in the virtual space, as an object moving instruction.

9. The production design support facility according to claim 8 in which the virtual space is composed of one or a plurality of virtual space elements, comprising:

a joint capable of mutually connecting the virtual space element, the component object, and the component supply unit object,

wherein the movement of the object to the arbitrary position in the virtual space is adapted to perform according to the joint.

10. The production design support facility according to any one of claims 1 to 9, comprising:

assembly procedure data reception means for receiving the assembly procedure data related to the prescribed product or for receiving the assembly procedure data related to other product different from the prescribed product.

11. The production design support facility according to any one of claims 1 to 10, comprising:

assembly procedure data edit instruction reception means for receiving an instruction to edit at least one of the data of a combination and an assembling order of the component in the assembly procedure data.

12. The production design support facility according to any one of claims 1 to 11, wherein

the component is managed by a component management number, and the component object data is managed by a component object

management number, and

the cooperation management means cooperates and manages the assembly procedure data and the component object data, by forming the assembly procedure data by associating the component number and the component object management number and by associating at least one of the combination of the component and the assembling order thereof, and the component number and the component object management number.

13. The production design support facility according to any one of claims 1 to 12,

wherein the component object data is described by associating with metadata by which the component related to the component object data or a prescribed concept on the component can be recalled.

14. The production design support facility according to claim 13, comprising:

fitness determination means for determining whether or not the metadata becoming a search source and the metadata becoming a search destination are fitted to each other, based on the metadata becoming the search source and the metadata becoming the search destination,

wherein when the fitness determination means determines that they are fitted to each other, the cooperation management

means is adapted to cooperate and manage the metadata becoming the search source and the metadata becoming the search destination.

15. The production design support facility according to claim 14, wherein

the metadata at least includes a character string; and  
in the character string in the metadata becoming the search source and the character string in the metadata becoming the search destination, the fitness determination means calculates a degree of an appearance of the character string in one of the metadata, in the character string in the other metadata, and when the degree shows a prescribed value or more, determines that the metadata becoming the search source and the metadata becoming the search destination are fitted to each other.

16. The production design support facility according to any one of claims 1 to 15, comprising:

cooperation management data storage means for storing the assembly procedure data and the component object data cooperated and managed by the cooperation management means, as cooperation management data in a manner of being cooperated and managed.

17. The production design support facility according to any one of claims 1 to 16, comprising:

graphic element work display means for displaying on screen the element working time outputted by the element working time output means, as a graphic element work that converts the element working time into graphics so as to correspond to a length of the element working time.

18. The production design support facility according to claim 17,

wherein the product is completed through one or a plurality of steps, and the steps are constituted by one or a plurality of element works, and when a plurality of steps are present, the graphic element work display means displays on screen the graphic element works by arranging them in a prescribed order for each step.

19. The production design support facility according to claim 18, wherein the prescribed order is a work order.

20. The production design support facility according to claim 19, comprising:

graphic element work display change instruction reception means for receiving a display change instruction related to the change of a display such as addition, deletion,



and rearrangement of the graphic element work,

wherein the graphic element work display means displays the graphic element work according to the display change instruction received by the graphic element work display change instruction receiving means.

21. The production design support facility according to claim 20, comprising:

assembly enabled relation determination means for determining whether or not one component and the other components related to a component object displayed in a virtual space have an assembly enabled relation, based on assembly procedure data managed by the cooperation management means,

wherein when the graphic element work display change instruction receiving means receives the display change instruction, the assembly enabled relation determination means determines whether or not the component object related to the graphic element work received by the graphic element work display change instruction receiving means is in an assembly enabled state, with reference to the cooperation management means.

22. The production design support facility according to claim 21,

wherein when the assembly enabled relation

determination means determines that the component object related to the graphic element work received by the graphic element work display change instruction receiving means is in the assembly enabled state, the element work output means outputs the element working time corresponding to the component object related to the graphic element work received by the graphic element work display change instruction receiving means.

23. The production design support facility according to any one of claims 1 to 22,

Wherein the element working time includes at least one of a man element working time showing a working time by a worker and a machine element working time showing the working time by a machine, and

the element working time output means divides the element working time into the man element working time and the machine element working time and outputs them.

24. The production design support facility according to any one of claims 1 to 23 in which the element working time changes by a separation distance between one assembly enabled component object and other assembly enabled component objects, comprising:

distance corresponding element working time data

storage means for arranging the element working time and the separation distance into a set and stores a plurality of sets of them,

wherein the element working time output means refers to the distance corresponding element working time data storage means, and determines and outputs the element working time corresponding to the separation distance.

25. The production design support facility according to any one of claims 1 to 23,

Wherein the element working time linearly or non-linearly changes in accordance with the separation distance between component objects in the virtual space, and

the element working time output means calculates the element working time, from the separation distance between component equipment objects in the virtual space, and outputs it at almost real time.

26. The production design support facility according to claim 25, comprising:

worker characteristic data storage means for storing worker characteristic data obtained by converting work characteristics of an individual worker related to the element working time into data,

wherein the element working time output means outputs

the element working time that reflects characteristics of the individual worker, by using the worker characteristic data stored in the worker characteristic data storage means.

27. The production design support facility according to any one of claims 1 to 26, comprising:

tact time display means for displaying on screen a tact time related to the product.

28. The production design support facility according to claim 27, comprising:

tact time parameter reception means for receiving a tact time parameter for setting the tact time;

tact time calculating means for calculating the tact time based on the tact time parameter received by the tact time parameter reception means,

wherein the tact time display means displays on screen the tact time calculated by the tact time calculating means.

29. The production design support facility according to any one claims 1 to 28, comprising:

step display means for modeling one or a plurality of steps and displaying on screen them; and

step display change instruction reception means for receiving the display change instruction related the change of

such as addition, deletion, and rearrangement of a modeled step.

30. The production design support facility according to claim 29, comprising:

assembly enabled relation determination means for determining whether or not one component and the other components related to a component object displayed in a virtual space have an assembly enabled relation, based on assembly procedure data managed by the cooperation management means,

wherein when the step display change instruction reception means receives the display change instruction related to the change of the display such as addition, deletion, and rearrangement of the modeled step, the assembly enabled relation determination means determines whether or not the component object related to a step received by the step display change instruction reception means is in an assembly enabled state, with reference to the cooperation management means.

31. The production design support facility according to claim 30,

wherein when the assembly enabled relation determination means determines that the component object related to the step received by the step display change instruction reception means is in the assembly enabled state, the element work output means outputs an element working time

corresponding to the component object related to the step received by the step display change instruction receiving means.

32. The production design support facility according to any one of claims 1 to 31,

wherein the component object data has weight data showing a weight of a component in a real space, and the object display means displays a component supply unit in the virtual space for supplying a prescribed component as a component supply unit object, and

total weight calculating means for calculating total weight data of a total weight of one or a plurality of components related to one or a plurality of component objects that can be held by the component supply unit object the cooperation management means comprises, based on the weight data.

33. The production design support facility according to claim 32, in which the component object data and component supply unit object data have gravity center position data showing each gravity center position in a real space, comprising:

arrangement balance state data calculating means for calculating an arrangement balance state of a component held by a component supply unit, as arrangement balance state data,

from the gravity center position data and the weight data of the component object or the total weight data calculated by the total weight calculating means and the gravity center position data of the component supply unit object.

34. The production design support facility according to claim 33,

wherein the arrangement balance state data calculating means is adapted to calculate the arrangement balance state data for each work shown by an assembling order of an assembly procedure data managed by the cooperation management means.

35. The production design support facility according to either of claim 33 or 34, comprising:

workability information output means for outputting workability information related to a workability of a worker, based on the arrangement balance state data calculated by the arrangement balance state data calculating means.

36. The production design support facility according to claim 35,

wherein the workability information outputted by the workability information output means is warning information showing that the arrangement balance state has an adverse affect on a work.

37. The production design support facility according to either of claim 35 or 36,

wherein the workability information outputted by the workability information output means is component object exchange information related to an exchange of a component object required for improving the arrangement balance.

38. The production design support facility according to any one of claims 1 to 37, constituted by a terminal device and a server device, which are connected so as to be able to communicate via a communication line network such as internet:

wherein at least one or more means of the object display means, the coordinate data acquisition means, and the element working time output means is/are provided, in one or both of the terminal device and the server device.

39. The production design support facility according to any one of claims 1 to 38, comprising:

verification information reception means for receiving verification information for obtaining a deviation between production and the production design, for the production in the real space performed correspondingly to a production design content performed by using the virtual space; and

deviation information production means for generating



deviation information showing the deviation between the verification information and the production design content, based on the verification information received by the verification information reception means and the production design content.

40. The production design support facility according to claim 39,

wherein the verification information is positional information showing a position of an object arranged on the real space based in the production design content.

41. The production design support facility according to claim 39 or 40,

wherein the verification information is execution time information showing execution time of one or a plurality of element works actually performed in the real space based on the production design content.

42. The production design support facility according to any one of claims 39 to 41,

wherein the verification information reception means is a verification information receiving means for receiving the verification information from an external prescribed device.

43. The production design support facility according to any one of claims 1 to 42, comprising:

deviation information output means for outputting the deviation information generated by the deviation information production means.

44. The production design support facility according to claim 43,

wherein the deviation information output means is a deviation information transmitting means for transmitting the deviation information to a prescribed external device.

45. The production design support facility according to any one of claims 39 to 44,

wherein the deviation information is correction information for correcting the deviation.

46. A production design support program designed to perform a production design of a prescribed product present in a real space and formed by assembling a prescribed component by displaying the component in a virtual space by activating a computer, wherein the program makes the computer perform as steps, steps comprising:

a cooperation management step that cooperates and manages assembly procedure data formed by showing a combination

of an assembly enabled component and an assembling order thereof and component object data for displaying the component in the virtual space as a component object;

an object display step that displays the component object in the virtual space based on the component object data;

a coordinate data acquisition step that acquires coordinate data of the component object displayed on the virtual space by the object display step; and

an element working time output step that outputs an element working time required for assembling the component, based on each coordinate data of one component object and the other component objects acquired by the coordinate data acquisition step, and assembly procedure data related to the one component object and the other component objects cooperatively managed by the cooperation management step.

47. A production design verification device used in executing a production design content in a real space, which is already performed in a virtual space of the production design support facility according to any one of claims 1 to 45, comprising:

verification information acquisition means for acquiring verification information for verifying a deviation between an execution content and the production design content, from the execution content performed on the real space based

on the production design content; and

verification information output means for outputting to outside the verification information acquired by the verification information acquisition means.

48. The production design verification device according to claim 47,

wherein the verification information is positional information showing a position of an object arranged on the real space based on the production design content.

49. The production design verification device according to either of claim 47 or claim 48,

wherein the verification information is execution time information showing an execution time of one or a plurality of element works performed in the real space based in the production design content.

50. The production design verification device according to any one of claims 47 to 49,

wherein the verification information output means is verification information transmitting means for transmitting the verification information acquired by the verification information acquisition means, to the production design support facility at almost real time.

51. The production design verification device according to any one of claims 47 to 50, comprising:

deviation information reception means for receiving from outside deviation information showing a deviation between the execution content and the production design content, based on the verification information outputted to outside by the verification information output means; and

deviation information report means for reporting the deviation information received by the deviation information reception means.

52. The production design verification device according to claim 51,

wherein the deviation information reception means is deviation information receiving means for receiving the deviation information from the production design support facility.

53. The production design verification device according to either of claim 51 or 52,

wherein the deviation information is correction information for correcting the deviation.

54. The production design verification device

according to any one of claims 47 to 53, which is a portable and wirelessly communicable terminal device.

55. A production design verification program designed to verify a deviation between the production design content and an execution content performed in a real space, when a production design content performed in a virtual space is performed in the real space,

wherein a computer is functioned as:

a verification information acquisition step that acquires verification information for verifying the deviation between the execution content and the production design content, from the execution content performed in the real space based on the production design content; and

a verification information output step that outputs to outside the verification information acquired by the verification information acquisition step.

56. The production design verification program according to claim 55, wherein the computer is further functioned as:

a deviation information reception step that receives from outside the deviation information showing the deviation between the execution content and the production design content, based on the verification information outputted to outside by

the verification information output step; and

a deviation information report step that reports the deviation information received by the deviation information reception step.